FEATURE

Global quantum internet dawns, thanks to China's Micius (墨子) satellite

By Michael Irving
https://newatlas.com/micius-quantum-internet-encryption/53102/?ref=yfp

The Micius satellite has sent quantum-encrypted data between China and Austria, bringing the world closer to a global quantum internet (Credit: University of Science and Technology of China)

Thanks to the internet, a wealth of information is at our fingertips – although the flipside is that sensitive data is often vulnerable to eavesdropping and theft. Quantum encryption can make that literally impossible, and in a new demonstration of that kind of security, scientists have now used the Chinese satellite Micius to send quantum-encrypted data between China and Austria.

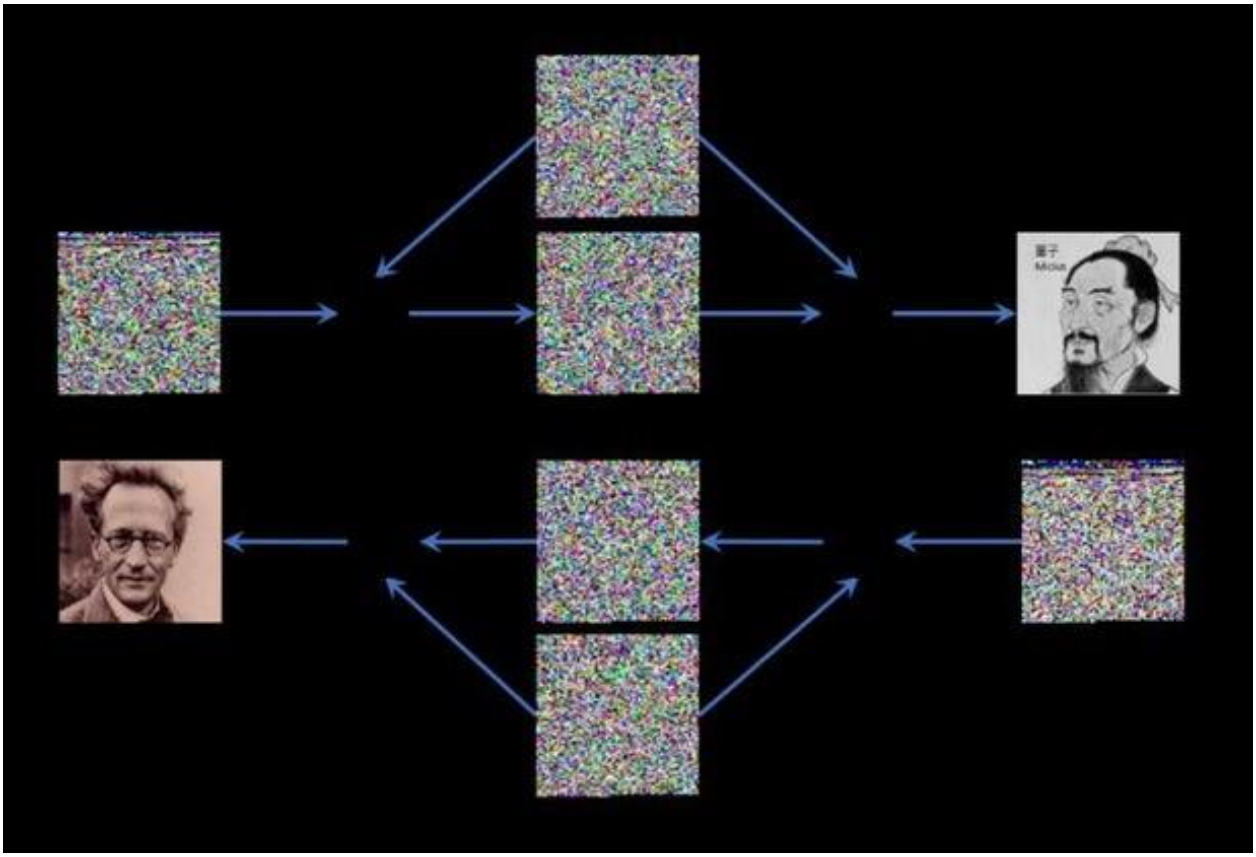
The experiment brings the world another step closer to a **global quantum internet**.

Micius was launched in August 2016, to experiment with quantum communications and encryption. **Conventional communications satellites transmit information via radio or microwave signals, but Micius uses quantum-entangled photons to effectively "teleport" information.** The two photons are inextricably linked, meaning if a user knows the state of one particle they can infer the state of the other, no matter how far apart they are.

Last year, Micius smashed the quantum entanglement distance record, sending a message over a distance of 1,200 km (746 mi).

As well as being almost instantaneous, quantum communications are extremely secure. It works in the same way as Schrödinger's famous thought experiment, involving a cat in a quantum superposition of being simultaneously both alive and dead. It's not until an observer peeks into the box and checks on the cat that the superposition collapses into one state or the other.

In quantum key distribution (QKD), a message is sent as individual photons that are in quantum superposition states – in data terms,



An image of Micius, the 5th-century Chinese scientist after whom the satellite is named, was sent from Beijing to Vienna, and the reply was an image of Erwin Schrödinger. To up the ante, the scientists then conducted a video conference call between the Chinese and Austrian Academies of Sciences.
About 2 GB of data was transmitted during the course of the 75-minute call, including a 560-kbit quantum key. The conference was also encrypted using the Advanced Encryption Standard AES-128, which refreshed the 128-bit seed keys once every second.

those photons represent both ones and zeroes at the same time. The message is coded and decoded through devices at each end, which effectively collapse each incoming photon into the required state, one or zero. If an unauthorized person tries to intercept the message along the way, the very act of observing it will cause the superposition of each photon to collapse into a random state, garbling the message for the hacker and alerting the intended recipient to the breach.

Scientists have now used Micius to transmit data encrypted with QKD between Austria and China, over a record distance of 7,600 km (4,722 mi).

The satellite first establishes a secure key between itself and one ground station, then another key with another station, and relays the information between the two. In this test, the messages were pictures with file sizes of about 5 kB, using 80-kbit secure quantum keys for one-time-pad encoding.

The experiments bode well for the roll-out of quantum communication networks on a global scale. Ground-based quantum networks are already in use in some areas such as China, with fibers able to transmit data over a distance of about 100 km (62 mi). With quantum satellites like Micius pitching in, a global quantum internet that's impenetrably secure and lightning fast could be on the horizon.

The research was published in the journal *Physical Review Letters*.
Source: University of Science and Technology of China

Editor's Note:

Mecius (**Mozi)**

Mozi (Chinese:墨子;Lat.as **Micius**, ca. 468– ca. 391 BC), original name **Mo Di** (墨翟), was a Chinese philosopher during the Hundred Schools of Thought period (early Warring States period). A book named after him, the *Mozi*, contains material ascribed to him and his followers.

According to Joseph Needham, *Mozi* (collected writings of those in the tradition of Mozi, some of which might have been by Mozi himself) contains the following sentence: 'The cessation of motion is due to the opposing force... If there is no opposing force... the motion will never stop. This is as true as that an ox is not a horse.' which, he claims, is a precursor to Newton's first law of motion.

Mozi also contains speculations in optics and mechanics that are similarly strikingly original, although their ideas were not taken up by later Chinese philosophers. The Mohist tradition is also highly unusual in Chinese thought in that it devoted time to developing principles of logic.